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[54] **VALVE CONSTRUCTION FOR AUTOMATIC SHUT-OFF SCREWDRIVERS AND THE LIKE**

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[51] **Int. Cl.**[5] **B25B 23/145**

[52] **U.S. Cl.** **173/176**; 173/178; 81/470

[58] **Field of Search** 173/176, 177, 178, 179, 173/180, 181, 182, 183, 5; 81/467, 469, 470, 473, 476, 477

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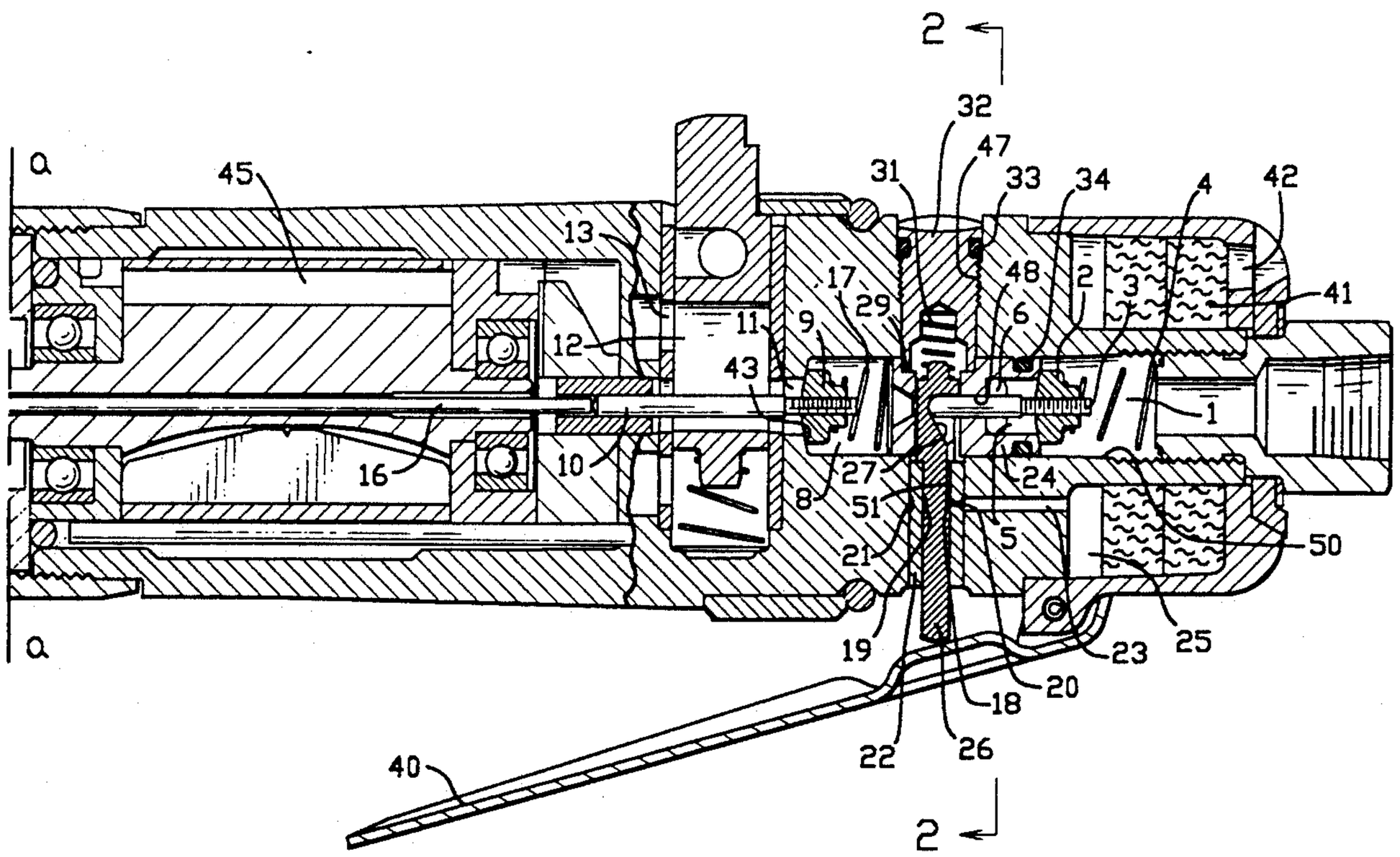
[57] **ABSTRACT**

A valve construction for dual valve automatic and manual shut-off screwdrivers and the like wherein construction of the valve features both valve elements in a central axial bore having a unique valve block which is held in place by a screw in a transverse bore, the unique construction permits operation of the manual valve by a pin in the cross bore, aligns the stem of the manual valve, and permits ready access to the stem and valve of the automatic shut-off device as well as assembly of all of the components through access in a single longitudinal bore.

14 Claims, 2 Drawing Sheets



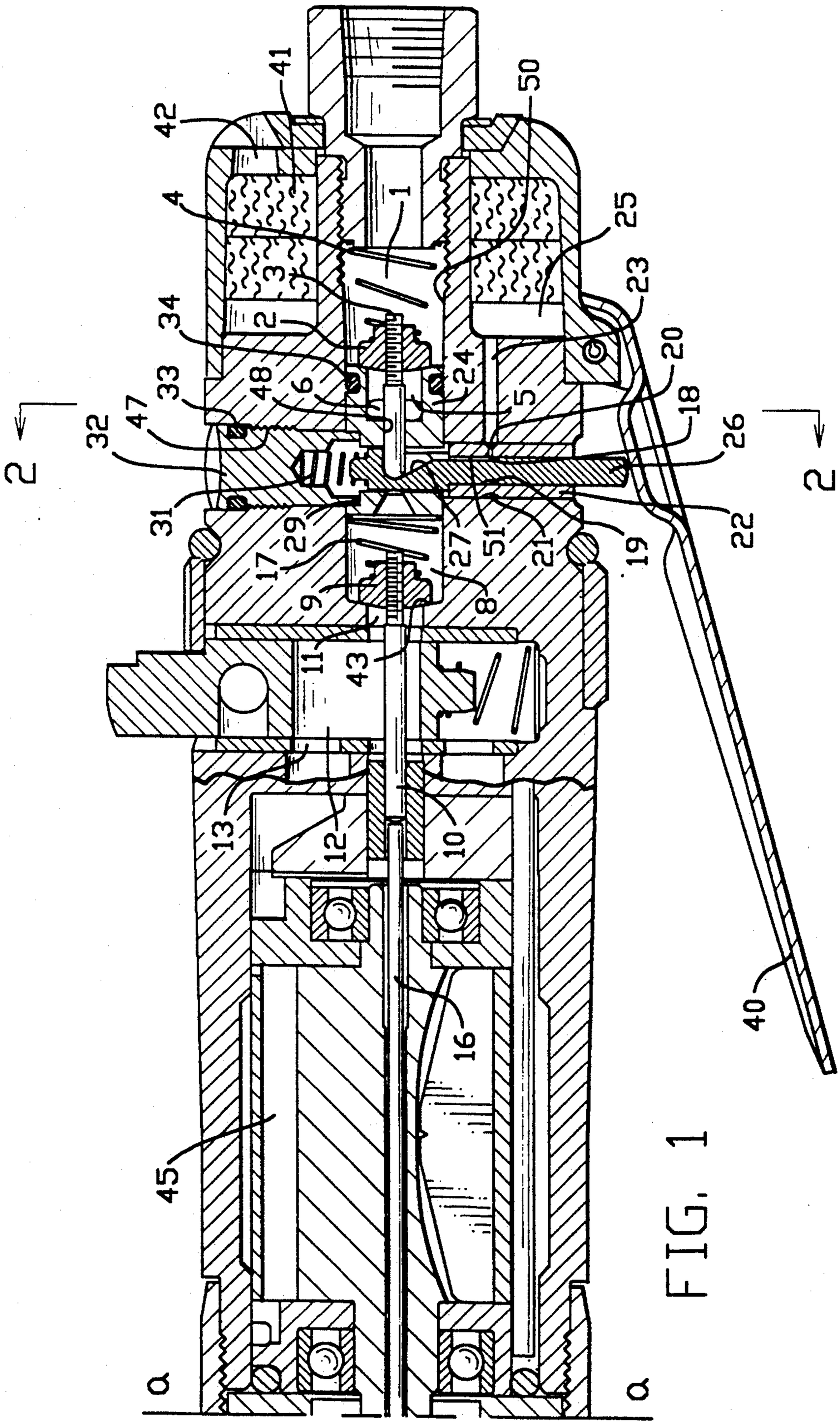

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FIG. 1

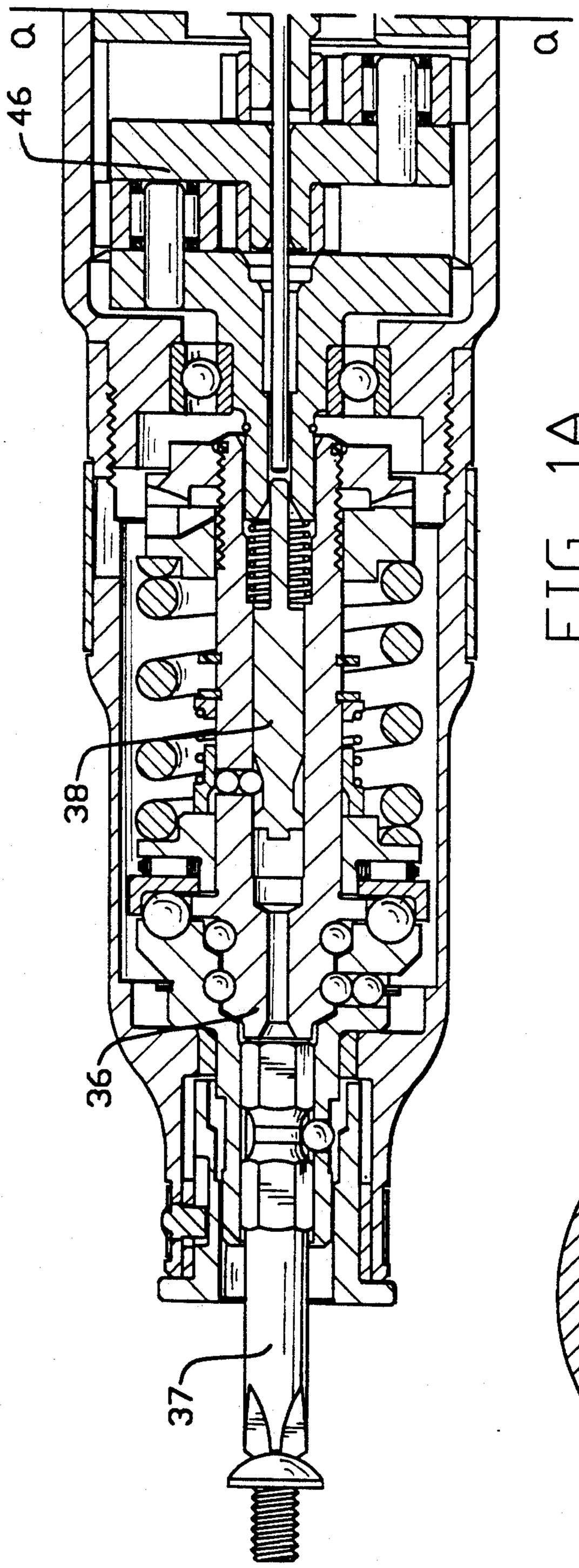

FIG. 1A

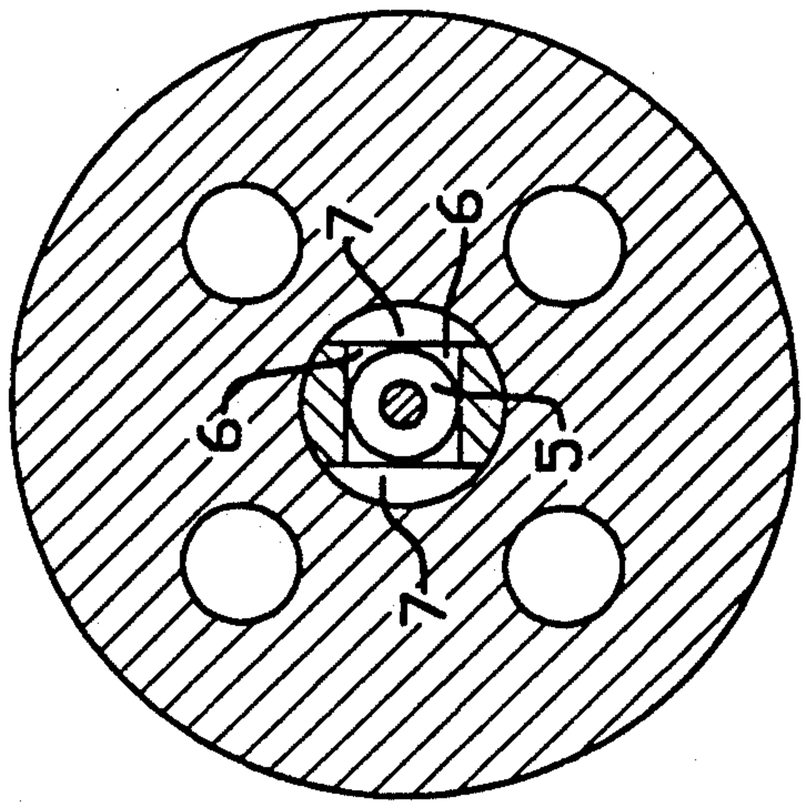

FIG. 2

VALVE CONSTRUCTION FOR AUTOMATIC SHUT-OFF SCREWDRIVERS AND THE LIKE

BACKGROUND OF THE INVENTION

The invention relates generally to automatic shut-off screwdrivers and the like and more particularly to a means for manufacturing and assembling sequential valves accomplishing both manual and automatic shut-off of the screwdriver.

In general, a means to override the auto start - auto shut-off functions of a torque controlled, fluid power screwdriver or similar equipment is sometimes needed. This need is brought about by things like: manual alignment of screwdriver bit with driving means on screw head; correcting for cross-threading or misalignment of fastener in a tapped hole; and other emergency shut-off reasons. A convenient and economical means of production and assembly of the sequential valving is required.

The foregoing illustrates limitations known to exist in the present automatic screwdriver art. Thus, it is apparent that it would be advantageous to provide an alternative directed to overcoming one or more of the limitations set forth above. Accordingly, a suitable alternative is provided including features more fully disclosed hereinafter.

SUMMARY OF THE INVENTION

In one aspect of the present invention this is accomplished by providing a valve construction for automatic shut-off screwdrivers and the like comprising an elongated bore in the tool having disposed therein a first and second valve element accomplishing respectively manual and automatic shut-off of the tool; one of the valve elements cooperating and guided by a valve body removably disposed from a one end in the elongated bore for shutting off fluid flow in the elongated bore in one operating mode, and the valve body being secured in the elongated bore by a fastener in a cross bore intersecting the elongated bore; and the other of the valve elements cooperating with the other end of the bore to effect shut-off of fluid flow in the elongated bore in an alternative operating mode.

The foregoing and other aspects will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawing figures.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

FIG. **1** is a longitudinal cross section view illustrating an embodiment of the construction of an automatic screwdriver showing the detail of the valve construction according to the present invention; and

FIG. **2** is a cross section of the automatic screwdriver according to the present invention taken at section **2—2** on Fig. **1** showing further details of a construction of the valve block.

DETAILED DESCRIPTION

The claims of this invention are in regard to the arrangement of manual valve and automatic shut-off valve being mounted within a common housing bore **50**; means of air transfer from one valve to another; and the method used to bleed or purge fluid power supply chamber between the two valves.

The attached illustration shows an adjustable, two-piece manually operated valve with stem **3** threaded and adjustable within valve body **2**. The valve assembly is held closed by fluid power supply pressure and bias spring **4**. To actuate the valve into an open position, an operator depresses the actuator pin **26**, which is guided in bushing **22** and cooperates in a cross bore **51** in the valve block **24**. This is accomplished either directly or by a lever means **40** as shown. As the pin **26** is pushed into the bushing **22**, the ramp **27** displaces valve stem **3**, which is guided in an axial bore **48** in valve block **24**, and valve body **2** away from valve block **24**. Fluid power supply can now pass from inlet to chamber **1**, around valve body **2**, into valve block chamber **5**, through valve block slots **6**, along chambers **7** (best seen in FIG. **2**), into chamber **8** and then be blocked by valve body **9**. Forward and reverse exhaust passageways are also shown in Fig. **2** but are not part of the novel construction of the present invention. Simultaneously, as actuator pin **26** is depressed into bushing **22**, the vent passage **19** is moved away from hole **20** until the diameter of pin **26** seals fluid power supply from passing through hole **20**, groove **21**, passageway **23**, chamber **25**, silencer **41**, and exhaust port **42**, etc., to atmosphere. The manual override system is now in the "on" condition phase, awaiting the second phase actuation b the operator.

The second phase starts with the operator engaging the fastener with screwdriver bit and then pushing the tool towards fastener. The bit now axially moves the clutch assembly rearward, moving rod **16** against valve stem **10**, having valve body **9** threaded onto and adjusted to be moved away from valve seat **43**. Fluid power supply may now pass from chamber **8**, around valve body **9**, into chambers **11**, **12**, **13**, and into the motor **45**. The motor **45** is now operating to transmit power through the gearing **46**, clutch **36**, screwdriver bit **37**, and finally to the fastener **38**. Common construction features of the housing, motor, gearing and the like are shown on FIG. **1** but not otherwise described herein as they are readily understood by one skilled in the power tool art.

The normal cycle mode is to allow the motor to run until the resistant torque at the fastener exceeds a preset torque limit within the clutch assembly. The clutch **36** shown is generic of the type used to sense a preset torque limit, then actuate some components like cam pin **35** to allow rod **16**, valve stem **10** with valve body **9** to move forward due to bias force of spring **17** and fluid power pressure force acting on valve body **9**. When valve body **9** seats around port **11**, fluid power supply to the motor has been cut off and motor quickly stops.

Abnormal or emergency conditions such as fastener cross-threading, etc., might require that the operator would want to interrupt the normal cycle mode. This is accomplished by the operator's release of the force maintaining valve pin actuator **26** to be depressed. The bias force from spring **31** in conjunction with bias force from spring **4** causes pin **26** to move out of bushing **22** and thereby allowing valve stem **3** to follow ramp **27** while moving forward until stopped when shoulder on pin **26** hits bushing **22**. The valve body **2** is now seated against valve block **24**. Fluid power supply is now blocked in chamber **1** by body **2** and seal **34** and motor quickly stops.

Concurrent with the valve actuator pin **26** moving out of bushing **22**, groove **19** has aligned with hole **20** and permits high pressure fluid power supply to be

exhausted from chambers between valve bodies **9** and **2** via slot **18**, groove **19**, hole **20**, hole **23**, chamber **25**, etc., to atmosphere. This function is desirable to prevent a balance of forces occurring that could keep valve body **2** in a "passing" position of fluid power supply.

It should now be apparent to one skilled in the art that with the first phase valve control, an operator can engage a fastener with the screwdriver bit with some axial force that would move rod **16**, valve stem **10**, and valve body **9** into a position of "opening" the port **11** and chamber **8** to fluid power supply; however, the supply is blocked at valve body **2**. The tool will not start until the operator activates the overriding valve actuator pin **26**, valve stem **3**, and valve body **2** into an open position.

The preferred design shown illustrates a claimed arrangement of the valve block **24** being oriented in common housing bore **50** and held in position therein by flat **29** being clamped by screw **32** having a seal **33** in threaded cross bore **47**. The arrangement is unique in the multi-functional features of the valve block **24** that acts as a seat or stop for spring **17**, valve seat for valve body **2**, holder for seal **34**, guide for valve stem **3**, while being easily removable for service and adjustment of valve stem **10** relative to valve body **9**.

Having described the invention, what is claimed is:

1. A valve construction for an automatic and a manual shut-off tool and the like comprising:

an elongated bore in the tool having disposed therein a first and second valve element accomplishing respectively manual and automatic shut-off of said tool, one of said valve elements cooperating with and guided by a valve body removably disposed from a one end in said elongated bore for shutting off fluid flow in said elongated bore in one operating mode, and said valve body being secured in said elongated bore by a fastener in a cross bore intersecting said elongated bore, and the other of said valve elements cooperating with the other end of said elongated bore to effect shut-off of fluid flow in said elongated bore in an alternative operating mode.

2. A valve construction for automatic and manual shut-off tools according to claim **1**, wherein said tool generally comprises a cylinder having an axis and said elongated bore is an axial bore.

3. A valve construction for automatic and manual shut-off tools according to claim **1**, wherein said elongated bore cooperates with a pressure fluid inlet at said one end of said elongated bore for receiving pressure fluid in said elongated bore.

4. A valve construction for automatic and manual shut-off tools according to claim **1**, wherein said one of said valve elements is manually operated and said other of said valve elements is automatically operated at a predetermined torque output of said tool.

5. A valve construction for automatic and manual shut-off tools according to claim **1**, wherein said one of said valve elements is located in the elongated bore having an operating element proximate said cross bore and is operable by a pin inserted in said cross bore.

6. A valve construction for automatic and manual shut-off tools according to claim **5**, wherein said pin is inserted in a sleeve permitting radial translation of said pin in an extended portion of said cross bore and said pin is provided with a ramp for cooperating with and axially displacing said one of said valve elements upon selectively displacing said pin in said cross bore.

7. A valve construction for automatic and manual shut-off tools according to claim **1**, wherein said other of said valve elements is located at said other end of said elongated bore and cooperates with a partially closed end of said elongated bore to form a valve seat and said other of said valve elements is operable through said valve seat.

8. A valve construction for automatic and manual shut-off tools according to claim **7**, wherein said other of said valve elements is accessible and removable through said elongated bore through said pressure fluid inlet.

9. A valve construction for automatic and manual shut-off tools according to claim **3**, wherein said pressure fluid inlet is secured to said elongated bore so as to form a closure thereof.

10. A valve construction for automatic and manual shut-off tools according to claim **9**, wherein return springs are provided between said pressure fluid inlet and said one of said valve elements and said valve body and said other of said valve elements whereby assembly of said valve elements and positions of said valve body may be made from said one end of said elongated bore.

11. A valve construction for automatic and manual shut-off tools according to claim **10**, wherein said cross bore is provided with venting means for bleeding pressure trapped between said valve elements to permit reset of said other of said valve elements after automatic shut-off.

12. A valve construction for automatic shut-off screwdriver comprising:

an elongated bore in the screwdriver having disposed therein a first and second valve element accomplishing respectively manual and automatic shut-off of said tool, one of said valve elements cooperating with and guided by a valve body removably disposed from a one end in said elongated bore for shutting off fluid flow in said elongated bore in one operating mode, and said valve body being secured in said elongated bore by a fastener in a cross bore intersecting said elongated bore between said first and said second valve element; and the other of said valve elements cooperating with the other end of said elongated bore to effect shut-off of fluid flow in said elongated bore in an alternative operating mode;

said elongated bore cooperates with a pressure fluid inlet at said one end of said elongated bore for receiving pressure fluid in said elongated bore;

said one of said valve elements is manually operated and said other of said valve elements is automatically operated at a predetermined torque output of said tool; and

said one of said valve elements is located in said elongated bore and has an operating element proximate said cross bore and is operable by a pin inserted in said cross bore.

13. A valve construction for automatic shut-off screwdriver according to claim **12**, wherein said pin is inserted in a sleeve permitting radial translation of said pin in an extended portion of said cross bore and said pin is provided with a ramp for cooperating with and axially displacing said one of said valve elements upon selectively displacing said pin in said cross bore; and said other of said valve elements is located at said other end of said elongated bore and cooperates with a partially closed end of said elongated bore to form a valve

seat and said other of said valve elements is operable through said valve seat.

14. A valve construction for automatic shut-off screwdriver according to claim **12**, wherein said other of said valve elements is accessible and removable through said elongated bore through said pressure fluid inlet; said pressure fluid inlet is secured to said elongated bore so as to form a closure thereof; and return springs are provided between said pressure fluid inlet and said one of said valve elements and said valve body and said other of the valve elements whereby assembly of said valve elements and positions of said valve body may be made from said one end of said elongated bore.

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